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Experimental Study of Water Transport through Hydrophilic Nanochannels[1] MOHAMMAD AMIN ALIBAKHSHI, QUAN XIE, YINXIAO LI, CHUANHUA DUAN, Boston University — In this paper, we investigate one of the fundamental aspects of Nanofluidics, which is the experimental study of water transport through nanoscale hydrophilic conduits. A new method based on spontaneous filling and a novel hybrid nanochannel design is developed to measure the pure mass flow resistance of single nanofluidic channels/tubes. This method does not require any pressure and flow sensors and also does not rely on any theoretical estimations, holding the potential to be standards for nanofluidic flow characterization. We have used this method to measure the pure mass flow resistance of single 2-D hydrophilic silica nanochannels with heights down to 7 nm. Our experimental results quantify the increased mass flow resistance as a function of nanochannel height, showing a 45% increase for a 7nm channel compared with classical hydrodynamics, and suggest that the increased resistance is possibly due to formation of a 7-angstrom-thick stagnant hydration layer on the hydrophilic surfaces. It has been further shown that this method can reliably measure a wide range of pure mass flow resistances of nanoscale conduits, and thus is promising for advancing studies of liquid transport in hydrophobic graphene nanochannels, CNTs, as well as nanoporous media.

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